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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/684,503	10/15/2003	Hitoshi Sakamoto	243863US3DIV	4590

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EXAMINER	
BUEKER, RICHARD R	
ART UNIT	**PAPER NUMBER**
1763	

NOTIFICATION DATE	DELIVERY MODE
05/17/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/684,503	SAKAMOTO ET AL.	
	Examiner	Art Unit	
	Richard Bueker	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *31 January 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *20 and 39-46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *20 and 39-46* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/9/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 20, 39-42 and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Claverie (5,091,209) taken in view of Torres (EP 573348) (see the attached English translation) and Madar (Microelectronic Engineering 19 (1992) pages 571-574) and optionally in further view of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172), and in further view of Lee (Thin Solid Films), Sasaoka (JP 06-196422) and Omi (JP 05-062917).

Claverie (Fig. 1) discloses a chemical vapor deposition (CVD) apparatus for formation of a copper film comprising a precursor feeding means for bringing a chlorine containing raw material gas into contact with a hot metallic copper element to produce a precursor within a CVD chamber housing a substrate to be coated, the precursor comprising the copper of the hot copper element and the chlorine contained in the raw material gas. Claverie teaches (see col. 2, line 50 to col. 3, line 5) that the copper containing precursor gas that is produced comprises CuCl. In Claverie's apparatus, the chlorine containing raw material gas is itself a precursor gas, and therefore the claim limitation of "precursor feeding means" reads on the chlorine containing gas feeding means of Claverie alone. The claim 20 limitation of "for bringing a chlorine-containing raw material gas into contact with a hot metallic filament" is a recitation of intended use that does not require the presence of a filament in the claimed apparatus. The chlorine

containing gas precursor feeding means of Claverie is inherently capable of feeding to a filament.

Claverie does not discuss the use of chamber heating means for heating an inner wall of the chamber to a predetermined temperature as recited in claim 20. Torres (EP 573348) discloses a copper film forming apparatus that is analogous to that of Claverie, and Torres (see page 13, lines 1-4 of the English translation) teaches that the walls of the coating chamber should be heated to prevent CuCl from depositing on the walls. Torres makes clear that deposition of CuCl on the chamber walls is undesirable. It would have been obvious to one skilled in the art to provide a chamber wall heater in Claverie's apparatus to prevent undesirable CuCl deposition on the chamber walls as taught by Torres. Madar is cited for his teaching (see page 572, second and third paragraphs, and Figs. 1 and 2) that CuCl was known in the art to be a non-volatile compound that is solid below 650° K. This teaching of Madar makes it further obvious to one skilled in the art to heat the chamber walls of Claverie to prevent undesirable deposition of CuCl.

As noted, above, claim 20 as written does not require the presence of a metal filament as part of the precursor feeding means. If for the sake of argument however, claim 20 was interpreted to require the presence of a hot metallic filament as a source for producing the metal containing precursor, such would still be obvious in view of the teachings of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172). Inoue (see fig. 2, element 11), Arena-Foster (fig. 4, element 64) and Bhandari (see paragraph bridging cols. 2 and 3 and also col. 3, lines 14-17) all disclose

vapor sources for CVD apparatus of a type analogous to that of Claverie, and they all teach that a hot metallic source element for forming the precursor gas can be in the form of a filament. It would have been obvious to one skilled in the art to modify the apparatus of Claverie by substituting a filament-type hot metallic element for the hot metal tube of Claverie, because Inoue, Arena-Foster and Bhandari make clear that a metal filament is an alternate equivalent form of a metal source that works well for Claverie's intended purpose, which is to successfully provide reactive precursor gas to a CVD reactor.

Claverie's Fig. 1 apparatus also includes a reducing gas heating means (filament 14 of Fig. 1) for heating a hydrogen containing reducing gas to a high temperature and thereby producing atomic hydrogen (H*) reducing gas, but Claverie does not discuss the use of a nozzle for injecting the hydrogen into the chamber, wherein a reducing gas heating filament is disposed within the reducing gas nozzle as now claimed.

Lee (see Fig. 1 and page 40, first paragraph) discloses an apparatus for depositing copper that is analogous to that of Claverie. As in Claverie, Lee deposits a copper film by using atomic hydrogen to reduce CuCl. Lee teaches that the atomic hydrogen can successfully be injected into the chamber from the outside. Lee teaches that his atomic hydrogen injection successfully lowers the temperature of a copper deposition process and deposits a high quality copper film (see the abstract of Lee).

It would have been obvious to one skilled in the art to modify the apparatus of Claverie by using an atomic hydrogen (H*) injection nozzle instead of the atomic hydrogen (H*) producing filament 14 of Fig. 1 of Claverie, because Lee teaches that

injecting atomic hydrogen is an alternate functionally equivalent way of using atomic hydrogen (H*) for depositing a high quality copper film at a low temperature as desired by Claverie.

Claim 20 as newly amended also requires the use of an atomic hydrogen (H*) injection nozzle that has a filament for heating a hydrogen containing reducing gas, the filament being disposed in the injection nozzle, and Lee does not discuss the use of such a filament containing nozzle as the atomic hydrogen (H*) source.

Sasaoka (JP 06-196422) (see Fig. 1 and paragraph 7 of the attached English translation) and Omi (JP 05-062917) (see Figs. 1, 3 and 4) each teaches that it was well known in the prior art to supply atomic hydrogen (H*) reducing gas to a CVD deposition chamber by means of a hydrogen supply nozzle that contains a hot tungsten filament for heating H_2 gas and splitting the H_2 into monatomic H*. It would have been obvious to one skilled in the art to use an atomic hydrogen injection nozzle of the type taught by Sasaoka and Omi to inject the atomic hydrogen of Lee, because this type of atomic hydrogen injection nozzle was well known in the prior art for supplying atomic hydrogen reducing gas to a CVD deposition chamber.

Claims 43 and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Claverie (5,091,209) taken in view of Torres (EP 573348) (see the attached English translation), Madar (Microelectronic Engineering 19 (1992) pages 571-574), Lee (Thin Solid Films), Sasaoka (JP 06-196422) and Omi (JP 05-062917), and optionally in further view of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172) for the reasons stated in the rejection of claims 20, 39-42 and 45 above,

and taken in further view of Sun (6,161,499). Sun teaches (see col. 9, lines 10-14 and claim 5) that AC and DC power supplies are functionally equivalent for the purpose of resistively heating a filament. Therefore, it would have been prima facie obvious to one skilled in the art to choose a DC power source to heat the filament 14 of Claverie or the filaments of Arena-Foster, Bhandari and Inoue, because one skilled in the art would have expected a DC power source to successfully produce the desired heating of these hot filaments.

Claim 46 is rejected under 35 U.S.C. 103(a) as being unpatentable over Claverie (5,091,209) taken in view of Torres (EP 573348) (see the attached English translation) and Madar (Microelectronic Engineering 19 (1992) pages 571-574) and in further view of Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172), and in further view of Lee (Thin Solid Films), Sasaoka (JP 06-196422) and Omi (JP 05-062917), for the reasons stated in the rejection of claim 20 above. In the rejection of claim 20 above, it was noted that claim 20 did not positively recite a hot metallic filament being disposed within the claimed precursor feeding means. In claim 46, however, a hot metallic filament is positively recited as being disposed within the precursor feeding means. Therefore, Inoue (JP 60-116776), Arena-Foster (6,440,494) and Bhandari (6,001,172) are cited in this rejection of claim 46. Inoue (see fig. 2, element 11), Arena-Foster (fig. 4, element 64) and Bhandari (see paragraph bridging cols. 2 and 3 and also col. 3, lines 14-17) all disclose vapor sources for CVD apparatus of a type analogous to that of Claverie, and they all teach that a hot metallic source element for forming the precursor gas can be in the form of a filament. It would have been obvious to one

skilled in the art to modify the apparatus of Claverie by substituting a filament-type hot metallic element for the hot metal tube of Claverie, because Inoue, Arena-Foster and Bhandari make clear that a metal filament is an alternate equivalent form of a metal source that works well for Claverie's intended purpose, which is to successfully provide reactive precursor gas to a CVD reactor.

Applicants' arguments have been considered but are not persuasive for the reasons stated in the above prior art rejections.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kanai (JP 63-224217), Suzuki (JP 09-063964), Nishimori (JP 09-183697), Purdes (4,878,989), Ishihara (JP 62-196373) and Sano (JP 63-224216) provide further examples of reducing gas nozzles for injecting atomic hydrogen, wherein the nozzle has a reducing gas heating filament disposed in the nozzle.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Richard Bueker whose telephone number is (571) 272-1431. The examiner can normally be reached on 9 AM - 5:30 PM, Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571) 272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Richard Bueker
Primary Examiner
Art Unit 1763